# OPERATION
# AND
# SERVICE MANUAL

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PARTS LIST
SCHEMATICS
MARKERS (Optional)


## MODEL HD-1A

14776

SWEEP GENERATOR

# WARRANTY

## TELONIC INSTRUMENTS AND ACCESSORIES

Products manufactured by TELONIC INDUSTRIES, INC. are guaranteed against defective materials and workmanship for a period of one year (vacuum tubes excepted) from date of purchase. This warranty does not apply to instruments that have been altered, improperly handled or damaged in any way beyond our control.

Instruments must be examined immediately upon receipt, since claims for damage in transit will not be honored by the carrier unless prompt action is taken.

## CHANGES IN SPECIFICATIONS

The right is reserved to change the published specifications of equipment at any time, and to furnish merchandise in accordance with current specifications, without incurring any liability to modify equipment previously sold.

## RETURNING EQUIPMENT TO FACTORY

Factory service is available for repair and readjustment of this instrument. However, a description of the trouble, plus the MODEL AND SERIAL NUMBERS of the unit should be forwarded FIRST, whereupon instructions for correcting the trouble OR authorization for returning the equipment will be given. This applies to all units, whether under warranty or not.

# ADDENDUM SHEET

## MODEL HD-1A SWEEP GENERATOR INSTRUCTION MANUAL

The following should be considered a part of this manual.

Page 19 Parts List:

Circuit Reference F1:
Under Description- change from: Fuse, 3AG, 2a, 250V
to read: Fuse, 3AG, 2A (115VAC only)
Fuse, Slo-blo, 1a (230VAC only)
Under Telonic Part No.-change from: MP-6
to read: MP-6
MP-45

Circuit Reference R3:
Under Description- change from: RFW, 10KΩ, ±5%, 5W
to read: RFW, 7.5KΩ, ±5%, 5W
Under Telonic Part No- change from: R404
to read: R-406

Circuit Reference R313:
Under Description- change from: Same as R11
to read: RFC, 2.2MΩ, ±10%, 1/2 W
Under Telonic Part No.- Add: R-34

Circuit Reference L815:
Under Description- change from: IF, 0.68μh, ±15%
to read: IF, 1μh
Under Telonic Part No.- change from: L-103
to read: L-102

Schematic (Power Supply)

F1 change from: 2amp (P. C. B. or R. P.)
to read: 2 amp *(P. C. B. or R.P.)
R 3* change from: 10K, 5W
to read: 7.5K, 5W

Schematic ( Leveler & Blanking)
R313 change from: 1M
to read: 2.2M

Page 14 change last paragraph on page from : the dual _____ wire between terminals 2 and 3.
to read: The dual primary of the power transformer is normally wired in parallel for use with 115VAC lines. The winding can easily be reconnected in series for use with 230 Volt power.

Addendum Sheet
Model HD-1A

With the aid of the chassis layout, bottom view, locate terminals 1, 2, 3 and 4. Remove the jumper wires from terminals 1 and 2 and terminals 3 and 4. Connect a jumper wire between terminals 2 and 4. Remove the 2 amp fuse (F1) and replace with a 1 amp Slo-Blo fuse.

Page 19, Parts List:

Delete Circuit Reference L810 in its entirety

Circuit Reference R804:
Under Description - change from: Same as R501
to read: RFC, 100Ω, ±10%, 1/2W
Under Telonic Part No. - Add: R-15

Circuit Reference R805:
Under Description - change from: RFC, 180Ω, ±10%, 1/2W
to read: SC
Under Telonic Part No. - Delete: R-52

Circuit Reference R120: (Effective after Serial No. 15026)
Under Description change from: RFC, 3.3MΩ, ±10%, 1/2W
to read: RVC, 5MΩ, ±30%, 2/10W
Under Telonic Part No. - change from : R-49
to read: R-726

Delete: Circuit Reference L809 in its entirety

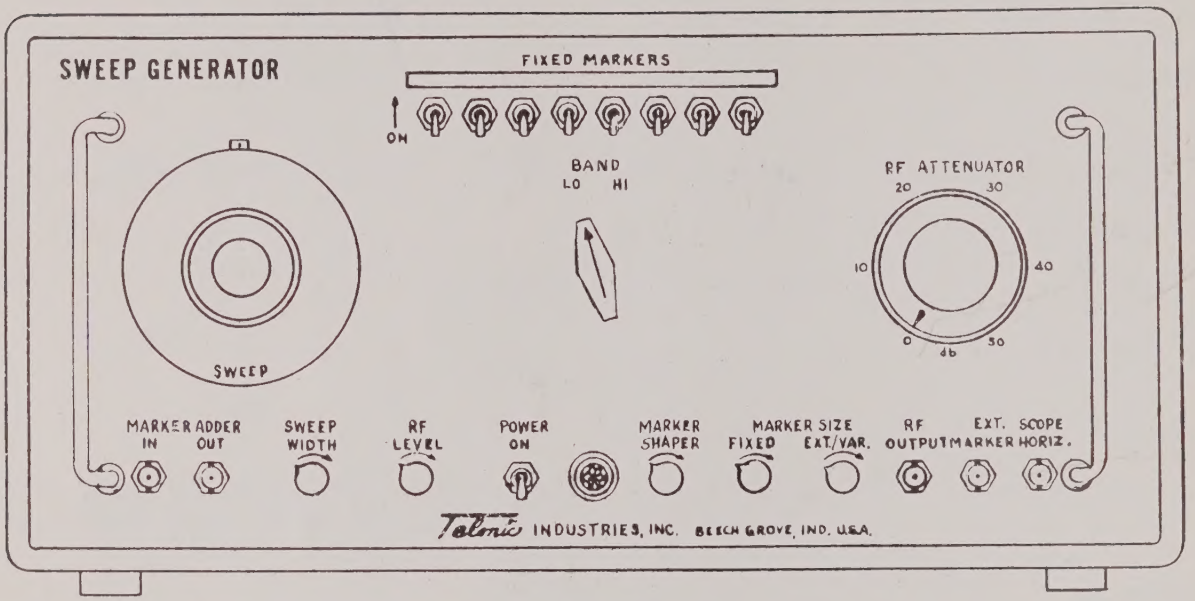
Circuit Reference L808:
Under Description - change from: Same as L802
to read: SC

Add: Circuit Reference R817:
Under Description - Add: RFC, 100K, 10%, 1W
Under Telonic Part No. - Add: R204

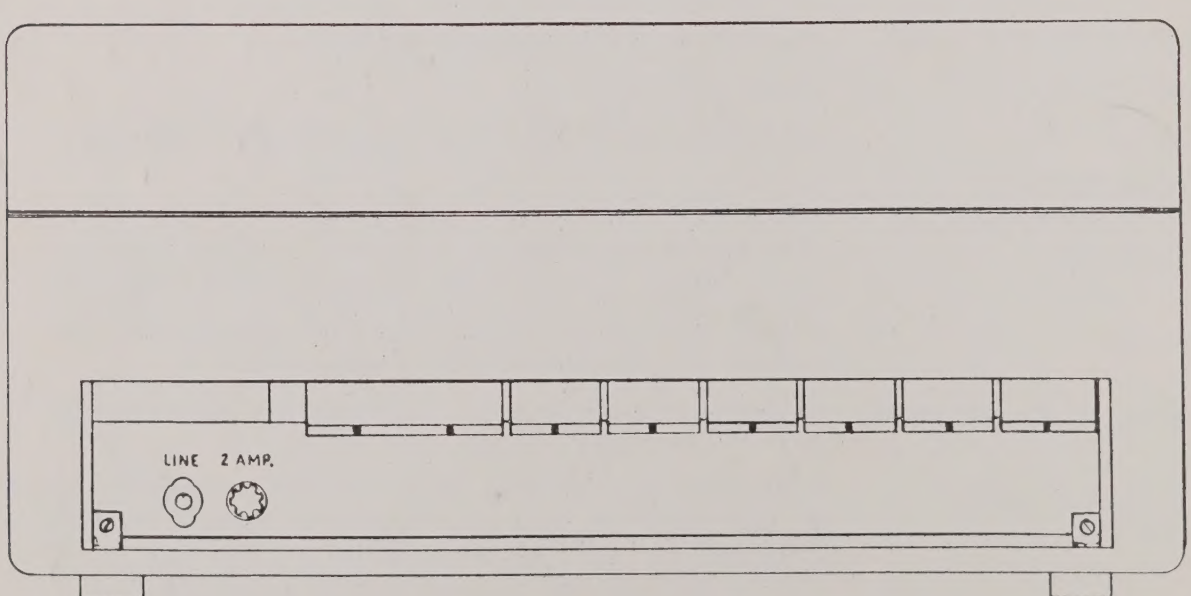
# SPECIFICATIONS

## MODEL HD-1A SWEEP GENERATOR

| | | |
|---|---|---|
| CENTER FREQUENCY | LOW BAND<br>0.5-400 MC | HIGH BAND<br>390-900 MC |
| FREQUENCY RANGE | 0.5-400 MC | 360-910 MC |
| SWEEP WIDTH | 200 KC-200 MC | 0.03-10% |
| OUTPUT | | |
| Voltage | 0.75 volts peak to peak | 2 volts peak to peak |
| Impedance | 50 ohms | |
| Flatness | ±5% over maximum sweep width | |
| ATTENUATION | | |
| Turret | 0, 10, 20, 30, 40, 50 db. | |
| Vernier | 0 to over 10 db. | |
| DISPLAY LINEARITY | Normally below 1.2:1. Set at the factory for below 1.2:1 at a center frequency of 300 Mc and 200 Mc sweep width with 50 Mc harmonic markers. | |
| RADIATION | Less than 10 microvolts | |
| SWEEP RATE | Line Frequency (50-60 c.p.s.). Specifications are verified at 60 c.p.s. | |
| ZERO BASE LINE | Oscillator off during sweep retrace | |
| SCOPE HORIZONTAL SWEEP | Approximately 15 volts peak-to-peak | |
| SOURCE VSWR | Normally below 1.2:1 | |
| POWER | 115/230v a.c., 50/60 c.p.s., approximately 120 watts | |
| MARKER SYSTEM | | |
| Birdy-By-Pass Marker Circuitry | The output of the marker oscillators is mixed with a signal from the sweep oscillator to produce beatnotes or birdies. These are amplified and superimposed upon the detected r-f output signal before it is applied to the vertical scope input. Amplitude and shape of the markers are adjustable over a wide range. | |
| External Marker Input | An external c-w signal of approximately 0.1 volts may be used to produce a "birdy" type marker. | |
| Plug-In Crystal Markers | Provisions are included for up to eight single frequency or four harmonic type plug-in crystal-controlled markers. These markers are optional and may be included in this instrument or added at a later date. See our literature for further details regarding these markers. | |
| PHYSICAL DESCRIPTION | Panel Size - 1/8" x 8 3/4" x 19"<br>Chassis Size - 2" x 14 1/2" x 17" | |


SWEEP GENERATOR
FIXED MARKERS
ON
BAND
LO HI
RF ATTENUATOR
20
30
10
40
0
db
50
SWEEP
MARKER ADDER
IN OUT
SWEEP
WIDTH
RF
LEVEL
POWER
ON
MARKER
SHAPER
MARKER SIZE
FIXED EXT./VAR.
RF
OUTPUT
EXT. SCOPE
MARKER HORIZ.
Talmic INDUSTRIES, INC. BEECH GROVE, IND. U.S.A.

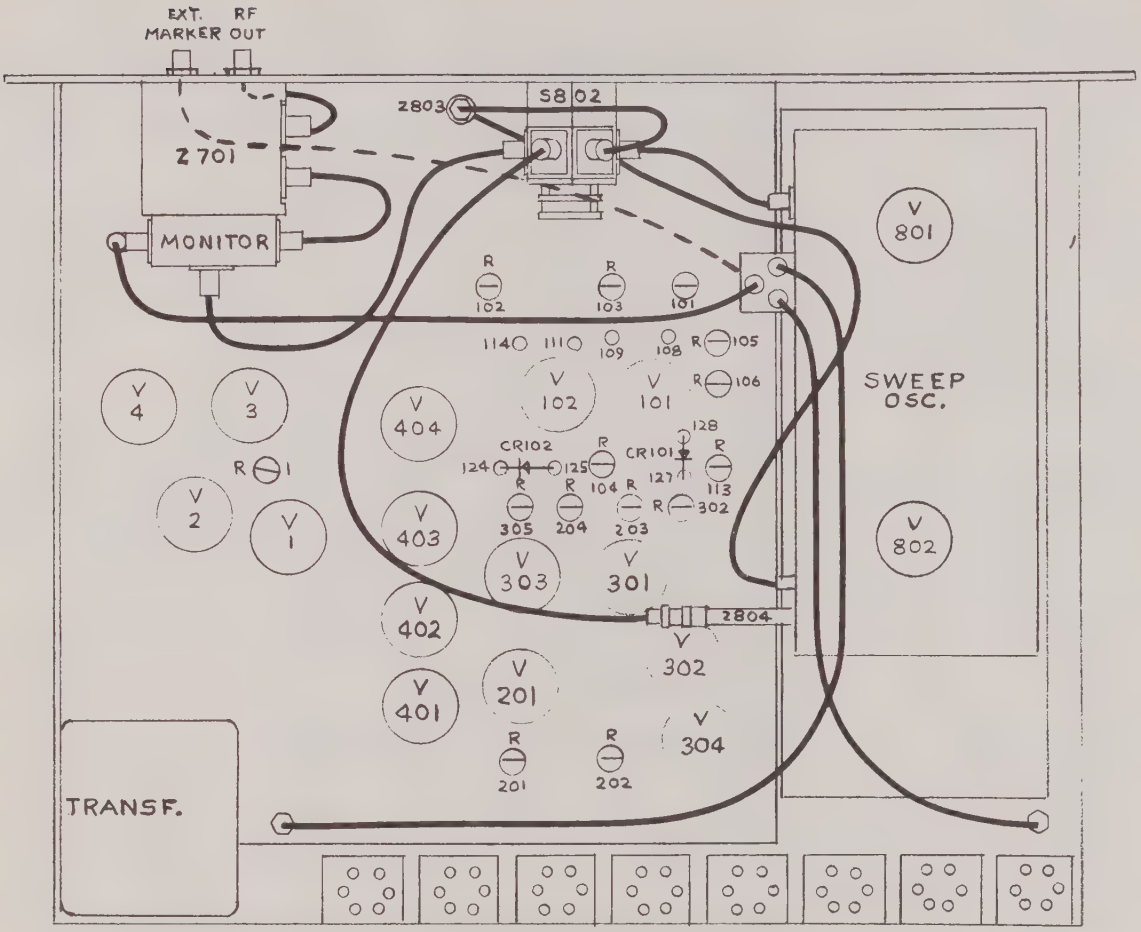
FRONT


LINE 2 AMP.

REAR

# DESCRIPTION OF FRONT PANEL

| | |
|---|---|
| SWEEP DIAL | Indicates center frequency of the sweep oscillator. Calibrated at minimum sweep width. |
| RF ATTENUATOR | Turret Attenuator provides indicated amounts of attenuation. |
| BAND SWITCH LO-HI | Selects low or high band as indicated on the sweep dial. |
| FIXED MARKERS | These switches supply B+ to the fixed markers (crystal plug-in units) when in the on position. |
| EXTERNAL MARKER | Marker input for external signal source. |
| RF OUTPUT | RF sweep output - BNC Connector - Impedance 50 ohms. |
| SWEEP WIDTH | Varies the amount of voltage supplied to the vibrating capacitor and can be used to vary the sweep width. |
| RF LEVEL | Determines the average B+ supplied to the sweep oscillator and may be used as a vernier level control. |
| POWER ON | Switches AC power on and off. |
| MARKER SHAPER | Varies the width of the marker signals. |
| MARKER SIZE | |
| Fixed | Varies the amplitude of the fixed markers (crystal plug-in units). |
| Ext/Var | Varies the amplitude of the external marker signals. |
| MARKER ADDER | |
| In | The demodulated signal from the device being tested is fed into this connector so that marker signals may be superimposed. |
| Out | This connector should be connected to the vertical input terminals of the scope for viewing the demodulated signal and markers. |
| SCOPE HORIZONTAL | This connector should be connected to the scope horizontal amplifier input. |




| | |
|---|---|
| V1 | 5651 |
| V2 | 6AU6 |
| V3 | EL84/6BQ5 |
| V4 | EL84/6BQ5 |
| V101 | 12AX7 |
| V102 | 12AX7 |
| V201 | 12AX7 |
| V301 | 6AU6 |
| V302 | 12AX7 |
| V303 | 6AU6 |
| V304 | EL84/6BQ5 |
| V401 | 12AX7 |
| V402 | 12AX7 |
| V403 | 12AX7 |
| V404 | 12AX7 |
| V801 | 6DZ4 |
| V802 | 6DZ4 |

# DESCRIPTION OF CHASSIS CONTROLS

R1 - B+ ADJUST — This control varies the bias on the amplifier, (V2), for the B+ regulator, (V3), and is adjusted to produce a regulated B+ voltage (B+2) of 175 volts.

R201 - BLANKING PHASE — This control adjusts the phase of the blanking pulse with reference to the phase of the sweep oscillator.

R202 - BLANKING WIDTH — This control is the grid resistor for the blanking pulse generator (V201). It is adjusted to blank one-half of the sweep cycle to produce a zero base line.

HIGH BAND ADJUSTMENT

R102 - SWEEP WIDTH LIMIT — This potentiometer controls a voltage supplied to the front panel SWEEP WIDTH control and is used to adjust the sweep width when the front control is set at maximum.

R104 - HORIZONTAL SIZE — This control adjusts the size of the horizontal output when the front panel SWEEP WIDTH control is set to its maximum position. It is adjusted to maintain a constant horizontal size at all sweep width settings.

R105 - HORIZONTAL PHASE — This control adjusts the phase of the scope horizontal sweep voltage with reference to the phase of the sweep oscillator.

R113 - LINEARITY — This control can be used to change the waveform of scope horizontal output (V101). It is normally set for best linearity at maximum sweep width.

R303 - LEVEL MINIMUM — This control is used to adjust the output level when the front panel LEVEL control is at its minimum position.

R305 - LEVEL MAXIMUM — This control is used to adjust the output level when the front panel LEVEL control is at its maximum position.

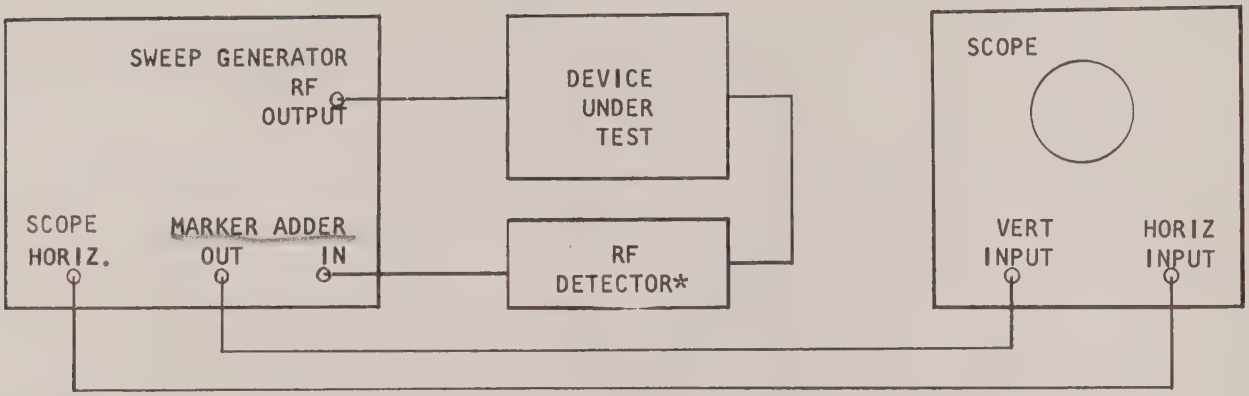
LOW BAND ADJUSTMENT

R101, R103 - SWEEP WIDTH ADJUSTMENT — These two potentiometers limit the voltage supplied to the dual front panel SWEEP WIDTH control and are used to adjust the sweep width when the FRONT PANEL control is set at maximum. R101 controls the sweep width on the low frequency side of the display and R103 the high frequency side.

R106 - HORIZONTAL PHASE — This control adjusts the phase of the scope horizontal sweep voltage with reference to the phase of the sweep oscillator.

R302 - LEVEL MINIMUM — This control is used to adjust the output level when the front panel LEVEL control is at its minimum position.

R304 - LEVEL MAXIMUM — This control is used to adjust the output level when the front panel LEVEL control is at its maximum position.




TYPICAL SET UP - The following procedure is recommended for setting up this instrument in test position.

1. Connect unit to proper power line voltage and turn POWER ON switch to ON position.

2. Make connections to the scope, the device under test, and RF Detector as shown above. All connectors located on the sweep generator are BNC type and it is recommended that RG cable be used for all connections. This insures good ground connection between each device, minimizes hum, leakage from unit and pick up of spurious external signals. The cable that is used to connect the RF OUTPUT to the device under test should match the impedance of the sweep generator. If the input impedance of the device under test is different from the impedance of the sweep generator, a matching network should be used to insure a constant input signal.

3. Adjust the RF output level by means of the RF LEVEL control and the step RF ATTENUATOR to the proper input signal for the device being tested. Failure to do this will result in a misleading scope pattern.

4. Adjust the SWEEP WIDTH control and center frequency SWEEP DIAL to cover the desired frequency range.

5. MARKERS
   Markers may be produced by one or more of the following methods.
   A. Plug-in crystal markers (C type).
   B. Plug-in crystal harmonic markers (CDH or CH type).
   C. External C.W. Signal.
   First turn on marker unit or inject external C.W. signal and adjust MARKER SIZE and SHAPER until markers are of a convenient size and width.

*See Telonic literature for detector recommended for use with this instrument.

## INTERNAL CONTROL ADJUSTMENT

PRINTED WIRING BOARD CONTROLS are adjusted at the factory and normally do not require any readjustment. However, should it be desirable to check adjustments, follow these steps:

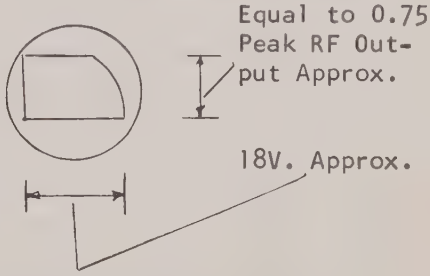
1-Connect unit as shown under operating instructions but omit the device under test. The recommended detector for the unit is the Telonic XD-3A. Turn unit on.

2-B+2 ADJUSTMENT: Adjust R1 to provide a regulated B+ voltage of 175 volts.

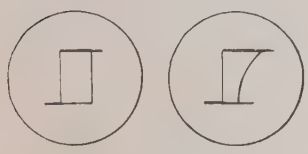
THE FOLLOWING ADJUSTMENTS ARE MADE WITH THE BAND SWITCH IN THE HI BAND POSITION

3-BLANKING PHASE and WIDTH ADJUSTMENTS: Set front panel SWEEP WIDTH control to its maximum counter-clockwise position, front panel RF OUTPUT LEVEL control to its maximum clockwise position and the ATTENUATOR to its 0 db. position. The "normal" pattern which should appear on the oscilloscope may be nearly rectangular, may have a rounded upper right corner as shown in the figure to the right, or may be between the two in appearance. If not, adjust BLANKING PHASE and WIDTH controls, R201 and R202. If BLANKING PHASE and WIDTH controls are misadjusted, the pattern seen may be similar to one of those shown below.

.25V ON SCOPE

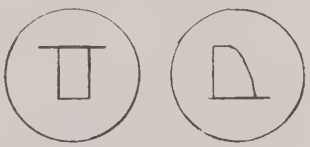



BLANKING PHASE



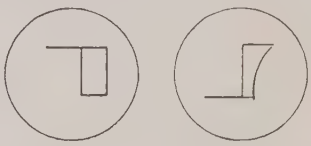
Misadjusted

BLANKING WIDTH



Misadjusted

BLANKING PHASE & WIDTH



Misadjusted

4-RF OUTPUT LEVEL MIN and MAX ADJUSTMENTS: With the front panel RF LEVEL control in its maximum clockwise position, adjust LEVEL MAXIMUM control, R305, until vertical height of the pattern equals 3/8 of the peak to peak RF output voltage shown on the specification sheet, Page 1. Since the RF Detector is approximately 75% the actual RF output voltage will be approximately as specified. Turn turret attenuator to 10 db. position and record the height of the pattern. Return the turret attenuator to the 0 db. position. Turn the front panel RF LEVEL control to its maximum counter-clockwise position and adjust LEVEL MINIMUM control, R303, until the height of the pattern is slightly less than it was with 10 db. inserted in the output circuit. This procedure insures that the RF LEVEL control will provide over 10 db. of vernier attenuation.

5-HORIZONTAL PHASE and SIZE adjustments: Return the front panel RF LEVEL control to maximum clockwise position. Set the HI/LO switch to the HI position. Rotate the SWEEP WIDTH vernier fully counter-clockwise. If the pattern is not normal, adjust HORIZONTAL PHASE, R105. Note the amplitude of the horizontal deflection on the oscilloscope. Rotate the SWEEP WIDTH control fully clockwise. Adjust HORIZONTAL SIZE (high band) R104, for the same horizontal deflection as seen at minimum sweep width.

MARKERS MUST BE PROVIDED FOR THE FOLLOWING ADJUSTMENTS

6-SWEEP WIDTH ADJUSTMENT: With the front panel SWEEP WIDTH control in its maximum clockwise position, adjust the SWEEP WIDTH LIMIT, R102, to provide the maximum sweep width as shown on the specification sheet, Page 1.

7-LINEARITY ADJUSTMENT: Linearity may best be adjusted when a number of markers are present on the display. In the factory, a harmonic generator is used for this purpose. The LINEARITY control, R113, is adjusted for equal spacing between the markers. Adjusting the

LINEARITY control will change the size of the scope horizontal signal, therefore, the HORIZONTAL SIZE control must be readjusted; see step 5. The HORIZONTAL PHASE control also has an effect on linearity and can be adjusted slightly to obtain optimum linearity. Generally it is adjusted to spread the markers at the low frequency side of the display as much as possible and still maintain a rectangular pattern. If a harmonic generator is not available, a variable marker may be used. The linearity adjustment is made so that there is an equal frequency difference from the center of the presentation to each side.

THE FOLLOWING ADJUSTMENTS ARE MADE WITH THE BAND SWITCH IN THE LOW BAND POSITION

8-RF OUTPUT LEVEL MIN. and MAX. ADJUSTMENTS: Adjustment procedure is the same as the hi band adjustments outlined in step 4, substituting R304 for R305 (MAX. ADJUSTMENT) and R302 for R303 (MIN. ADJUSTMENT). R304 must not be adjusted for more than rated output since this will cause an unleveled RF output signal. .28 V ON SCOPE

9-HORIZONTAL PHASE ADJUSTMENT: Set SWEEP WIDTH control to its maximum clockwise position. If pattern is not rectangular, adjust HORIZONTAL PHASE, R106, until a rectangular pattern is obtained.

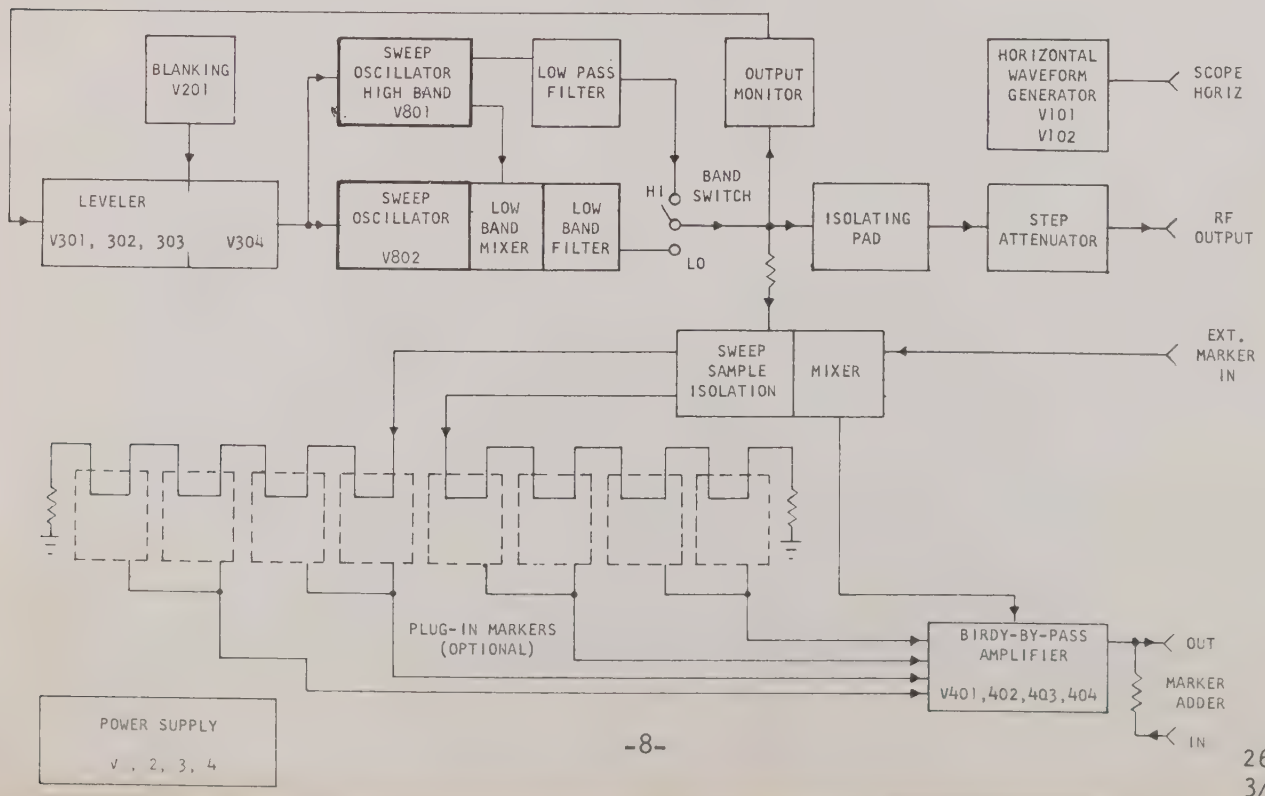
10-HORIZONTAL SIZE ADJUSTMENT: Check for any change in horizontal size between minimum and maximum sweep width as on the high band. If necessary, adjust HORIZONTAL SIZE (low band), R120, at maximum sweep width to give horizontal size the same as at minimum sweep width.

MARKERS MUST BE PROVIDED FOR THE FOLLOWING ADJUSTMENTS

11-SWEEP WIDTH ADJUSTMENT: With the front panel SWEEP WIDTH control set for maximum sweep width and the SWEEP DIAL set for a frequency of 300 Mc, adjust R101 until the lowest frequency obtained on the display is 200 Mc. R103 is next adjusted until the highest frequency obtained on the display is 400 MC.

12-LINEARITY: There are no linearity controls for the low band. Linearity is obtained by the proper adjustment of the SWEEP WIDTH controls, R101 and R103, and by the HORIZONTAL PHASE control, R106.

BLOCK DIAGRAM



## SWEEP OSCILLATOR

HI BAND: The sweep oscillator of this unit is a fundamental frequency type, using a 6AF4 tube and tuned line circuitry. A vibrating capacitor, consisting of a silver plated beryllium copper diaphragm is used to obtain the sweep. A low pass filter is included in the output circuitry to minimize harmonics in the R.F. output and to insure optimum performance of the leveling circuitry.

LOW BAND: The low band output is produced by the heterodyne method which combines the output of the Hi Band Sweep Oscillator with a second fixed tuned sweep oscillator. These two sweep oscillators are swept 180° out of phase which accounts for the wide sweep width since the sweep width of each sweep oscillator is added in the heterodyne output. This method of sweeping also produces excellent linearity since the nonlinearities of each sweep oscillator are canceled in the heterodyne output.

Four diodes in a bridge circuit produce the mixing of the two fundamental frequencies and due to the balanced nature of this mixer, a high output is produced with a minimum of harmonic or spurious content. A low pass filter removes the fundamental frequencies and allows the output or heterodyne frequencies to pass out through the monitor and attenuator to the final output. The oscillator circuits are similar and have similar frequency versus voltage or frequency versus temperature effects to minimize drifts.

## BLANKING CIRCUIT

The purpose of the blanking circuit is to produce a zero base line by removing B+ from the Sweep Oscillator during the sweep retrace. The blanking voltage is originated by a square wave producing circuit. A phased 6.3 volt sinewave is squared and amplified by the blanking tube. This square wave output of V201 controls V304 (EL84), the sweep oscillator voltage regulator tube, and thus deprives the Sweep Oscillator of voltage during one-half of each cycle. PHASE and WIDTH controls are provided for adjusting this blanking voltage to coincide with the horizontal and sweep drive signals.

## AUTOMATIC OUTPUT LEVELING CIRCUITRY

A sample of the sweep oscillator output is detected by the monitor diode, located in the monitor block. This detected signal is then amplified and used to control the plate voltage of the sweep oscillator. The RF LEVEL control adjusts the bias on the first stage of the amplifier. This causes the DC levels in the entire amplifier to change, and varies the average B+ supplied to the sweep oscillator from a minimum of 25V to over 100V. A small decrease in the sampling voltage causes a large increase in the B+ supplied to the sweep oscillator, and thus counteracts any amplitude variation as the oscillator is tuned over the range.

The operation of this circuit and of the sweep oscillator can be checked at Pin 1 of V301. The waveform at this point will normally show a flat output level over the entire band. Adjusting the RF LEVEL control will change this level.

To replace the monitor diode, remove the insulated holding screw in the monitor block and then remove diode from the block.

## HORIZONTAL SWEEP OUTPUT CIRCUITRY

HI BAND: In order to maintain good linearity, it is necessary to change the shape of the Horizontal Sweep signal for different settings of the SWEEP WIDTH control. This is necessary because of the non-linear characteristics of the vibrating sweep

capacitor. At high sweep width settings a non-linear sawtooth waveform is required for good display linearity. This waveform is produced by V101. A phased 6.3 volt sinewave is applied to the grid of V101A. The tube then clips and amplifies the grid signal so that a square wave is produced at the plate. This square wave is then shaped by a RC network in the plate circuit consisting of R113 and C104 to produce a non-linear sawtooth waveform. R113 (LINEARITY control) is a variable resistor and permits the shape of the waveform to be adjusted. This non-linear sawtooth voltage is then applied to V101B which is connected as a cathode follower. The output of th cathode follower is then applied to the Scope Horizontal Amplifier and compensates for the non-linear characteristics of the vibrating sweep capacitor at high sweep widths. At sweep widths from minimum to approximately 50%, the vibrating sweep capacitor is quite linear. In order to maintain almost perfect linearity for all values of sweep width, a potentiometer is ganged with the sweep width potentiometer which automatically changes the scope horizontal sweep voltage from a sinusoidal waveform at low sweep width settings to a non-linear sawtooth waveform at high sweep width settings.

LOW BAND: In order to maintain good display linearity at high sweep width settings, a linear sawtooth waveform is required. This linear sawtooth voltage is produced by V102. A square wave from the plate of V101A is applied to the grid of V102A. The tube then clips and amplifies the grid signal so that a square wave of opposite polarity appears at the plate. This square wave is then shaped by a RC network in the plate circuit consisting of R120 and C108 to produce a linear sawtooth waveform. This linear sawtooth waveform is then applied to V102B which is connected as a cathode follower. The output of the cathode follower is then applied to the Scope Horizontal Amplifier and compensates for the non-linear characteristics of the vibrating sweep capacitors at high sweep width settings. At sweep widths from minimum to approximately 50%, the vibrating sweep capacitors are quite linear. In order to maintain almost perfect linearity for all values of sweep width, a potentiometer is ganged with the sweep width potentiometer which automatically changes the scope horizontal sweep voltage from a sinusoidal waveform at low sweep width settings to a linear sawtooth waveform at high sweep width settings.

## POWER SUPPLY

The power transformer output of 140 volts AC is fed into a half wave voltage doubler, using silicon rectifying elements CR1 and CR2. B+ is taken off the capacity input filter to provide +375 volts unregulated to the plates of V3, (B+ regulator pass tube), V304 (oscillator pass tube), and V4 (marker B+ pass tube).

B+2 is the output of the electronic regulator circuit, consisting of V2 and V3, and provides +175 volts regulated. Potentiometer R1 controls the operating point of V2, regulator amplifier, and is set for proper B+2 output voltage.

B+3 is obtained by biasing the grid of V4 at approximately 85 volts positive, which causes current to flow through cathode resistor R20. The voltage at Pin 3, V4, is supplied to the Plug-In Markers and maintains its regulation due to the low impedance characteristics of the cathode follower circuit and provides approximately 100 volts.

The B- voltage is obtained by the half wave Silicon rectifier CR3. Regulator tube V1 maintains this voltage at -82 volts, and supplies bias voltage to the leveler circuit as well as a reference voltage for the electronic regulator.

Resistor R4 acts as a fuse, protecting the transformer and rectifiers from overload.

The primary of the power transformer is normally wired for 115 volt AC line operation. However, it can be converted to operate from a 230 volt AC source if desired. This conversion is described in the maintenance section.

# MARKER SYSTEM DESCRIPTION

## GENERAL

A sample of the sweep signal is mixed with the fundamental or a harmonic of the crystal plug-in marker units or external signal to produce beatnotes or birdies. These birdies are then amplified and superimposed upon the demodulated swept signal and applied to the vertical amplifier of the oscilloscope. The size and shape of the marker may be varied over a wide range by the SIZE and SHAPER Control of the birdy amplifier.

## EXTERNAL MARKER INPUT

The CW signal from the external marker input is fed into a diode mixer, where it is mixed with a sample of the sweep signal to produce birdies. The resultant birdy is then fed into the birdy-by-pass amplifier.

## PLUG-IN MARKERS

This unit has provisions for a maximum of eight single-frequency (C type) crystal markers or four harmonic (CDH type), or any combination. Each CDH type marker occupies the space of two C type.

## SINGLE FREQUENCY MARKERS (C TYPE)

These crystal markers are self-contained plug-in units. Additional units at other frequencies (within the range of the sweep generator) may be ordered and substituted for the original units.

The crystal oscillator units include the tube, crystal oscillator tuning, crystal diode mixer, and a tuned circuit selecting the sweep input frequency. A test point is provided for easy adjustment of the overtone crystal oscillator (this circuit used above 12 mc.). In making this adjustment, the crystal oscillator coil slug is adjusted for near maximum voltage at the test point. This is usually in the order of 2-5 volts as measured with a VTVM. The adjustment should be made just slightly off the peak on the low inductance side, since the effects of tuning are critical on the other side of the resonance curve. Crystal oscillators below 12 mc. are Pierce type oscillator circuits which require no tuning.

By tuning the sweep sample coil, the frequency of the sweep input signal can be varied and thus minimize unwanted markers generated from other harmonics of the crystal oscillator. The amplitude can be varied by adjusting the coupling.

HARMONIC MARKERS

The Telonic CDH type marker uses two tubes and occupies two of the plug-in positions on the marker strip.

In this marker unit, harmonics of the signal from a crystal-controlled oscillator are mixed with a portion of the sweep signal to produce a display of markers at regular intervals across the sweep range. Satisfactory markers are produced to over 1000 Mc in most of these units.

See our literature on plug-in markers for additional information.

POWER SUPPLY: Since a defect in the power supply will affect all circuits, it should be checked for proper operation before proceeding to other circuits.

| SUPPLY | NOMINAL VALUE | NORMAL VARIATION | NORMAL RIPPLE | WIRE COLOR* |
|---|---|---|---|---|
| AC Line | 115V | ---------- | ------ | ------ |
| B+1 | 375 | ±15 Volts | 6 to 15 volts | Red |
| B+2 | 175 | ±.5 Volts | 12 to 25 millivolts | Blue |
| B+3 | 100 | ±5-10 Volts | 15 millivolts to .5 volts | Orange |
| B- | -82 | ±2 Volts | 100 millivolts | White |
| 6.3 "A" | 6.3V AC | Main filament supply | | Green |
| 6.3 "B" | 6.3V AC | 180° out of phase with supply "A". Source of phasing and filament voltages. | | Gray |
| 6.3 "C" | 6.3V AC | Isolated filament voltage for tubes with cathodes above ground. | | Brown |

NEXT: If power supply is operating normal, use the block diagram to isolate the trouble to a major section. Check tubes, diodes, and adjustment of Front Panel and printed wiring board controls located within that section (see Page 7 for adjustment procedure). By the use of the schematic, ordinary difficulties encountered can be readily located and remedied. The following trouble-shooting chart is an additional aid to servicing:

| SYMPTOM | POSSIBLE CAUSE AND REMEDIES |
|---|---|
| Pilot Light Off and Unit Fails to Operate | Fuse open - replace. If second fuse opens - look for cause of overload, shorted wiring, components, etc. |
| B+1 Off Value or Excessive Ripple | Check R4, C1, C2, CR1, and CR2. |
| B+2 Off Value or Excessive Ripple | Check R1 for proper adjustment. Check R15, it will burn out if B+2 is overloaded. Check V1, V2, V3, tubes and circuitry. |
| B+3 Off Value or Excessive Ripple | Check R17 and R21 (these resistors adjust the voltage on the grid of V4, a cathode follower, which in turn determines the voltage on the cathode). Check R18 (this resistor will burn out if B+3 is overloaded). Check V4 and C2. |
| B- Off Value or Excessive Ripple | Check C3, C4, C5, CR3, R3, R5, and R6. Check V1 to see if it is lit properly (should be a steady orange glow). |

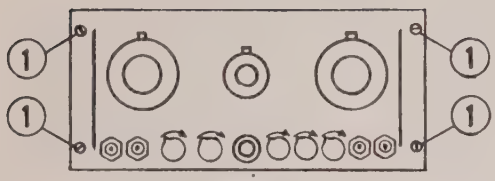
*Wire colors do not apply to shielded wires - single wires only.

| | |
|---|---|
| V1 Not Lit Properly | If replacing V1 and checking the above parts does not remedy the trouble, check the line voltage. Low line voltage could cause this trouble. Reducing the value of R3 slightly will usually eliminate this difficulty. |
| RF Output is Low or Zero | Check R314 - this resistor will burn out if the B+ to the Sweep Oscillator is overloaded.<br><br>Check B+ to the Sweep Oscillator, cathode of V304. It should be a positive square wave of 25-100 volts and should vary as the OUTPUT LEVEL control varies.<br><br>If it is normal, look for RF difficulties, defective tube, components, shorted or open wiring, etc. Replace mixer diodes in sweeper box, observe polarity.<br><br>If the voltage is low and does not respond to the LEVEL control, remove first V303 and then V201. When either of these tubes conducts, the voltage on the grid of V304 (pin 2) is reduced and thus decreases the B+ to the Sweep Oscillator. If removal of V201 allows the B+ on V304 (pin 3) to return to normal, check the blanking tube, controls, and associated circuitry. If removal of V303 causes the B+ to return to normal, check the LEVELER controls, V301 and V302, tubes, and associated circuitry. |
| Poor Leveling | Replace monitor diode. Also replace V301, V302, and V303. V301 is the most critical since it is in the first stage of the DC coupled amplifier. Resetting the printed circuit LEVEL controls is sometimes necessary if these tubes are replaced. |
| Weak Markers | Replace IN82 or IN34 crystal diode mixer. Check Birdy-By-Pass Amplifier, tubes and circuitry. |
| No Horizontal Output | Look for difficulty in the sawtooth circuitry V101, using the printed circuit board layout and schematic to check waveforms and voltages. |

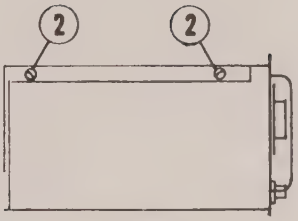
## CONVERSION FOR 230 VOLT POWER LINES

The dual primary of the power transformer is normally wired in parallel for use on 115 volt AC lines. If desired, the windings can easily be reconnected in series for use with 230 volt power. With the aid of the Chassis Layout, bottom view, locate terminals 1, 2, 3, and 4. Remove the jumper wires between terminals 1 and 2 and between terminals 3 and 4. Then install a jumper wire between terminals 2 and 3.

## RACK MOUNTED UNIT



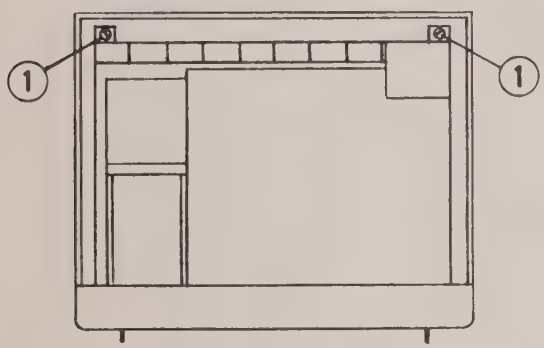

FRONT



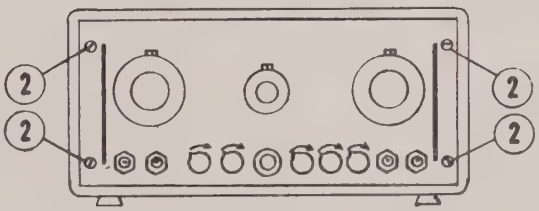

SIDE

Unit has front panel slotted or drilled for standard RTMA Mounting. Position unit in rack and install mounting screws in holes marked 1.
Dust cover removal: Remove four #8-32 thread-cutting screws, marked 2 (two on each side) and lift off cover for easy access to chassis.

## CABINET MOUNTED UNIT




TOP




FRONT

To remove chassis from cabinet; first remove the two #8-32 screws (marked 1 on top view above) at the back of the chassis (one on each side). These screws fasten the chassis to the cabinet guide rails. Second, remove the four #10-32 screws (marked 2 in front view above). The screws hold the panel to the cabinet.

Slide chassis out of cabinet by pulling forward on the two front panel handles.

To replace chassis in cabinet, insert the flanges on the bottom of the chassis side panels into the slot of the cabinet guide rails. Push chassis back into cabinet far enough for the slots in the side panel flanges to align with the retained nut in guide rail. Install the two #8-32 screws and tighten securely. Replace the four #10-32 screws in the front panel.

# PART VALUE INFORMATION

| SCHEMATIC PART DESIGNATION | |
|---|---|
| C | Capacitor |
| CR | Crystal Rectifier, Germanium Diode |
| F | Fuse |
| I | Incandescent Pilot Light |
| J | Jack or termination, Coaxial Connector |
| K | Cable |
| L | Coil |
| M | Meter or Motor |
| P | Plug, Coaxial Connector |
| R | Resistor, Fixed or Variable |
| S | Switch |
| T | Transformer |
| V | Tube |
| Z | Miscellaneous |

| SCHEMATIC VALUE ABBREVIATION | |
|---|---|
| Ω | ohms |
| K Ω | 1,000 ohms |
| M Ω | 1,000,000 ohms (megohms) |
| µf, uf | Microfarad |
| pf | Picofarad |
| µh, uh | Microhenry |
| mh | Millihenry |

RESISTORS - All resistors are 1/2 watt ± 10%, and are shown in ohms, unless otherwise specified.

NOTE: Resistors in the attenuator pads are ± 2%.

CAPACITORS - All Capacitors are shown in picofarads (pf) unless otherwise specified.

COILS - All coils are shown in microhenries (µh) unless otherwise specified.

PARTS LOCATION - F.P. Front Panel
P.C.B. Printed Circuit Board
R.P. Rear Panel
C.H. Chassis
T.P. Test Point

PARTS NUMBERS - LOCATION INFORMATION

1 - 99 - Power Supply
101 - 199 - Horizontal and Alternate Sweep Drive Circuit
201 - 299 - Blanking
301 - 399 - Leveler
401 - 499 - Birdy-By-Pass
501 - 599 - Mixer & Plug-In Markers
601 - 699 - Variable Markers
701 - 799 - Attenuators
801 - 899 - Sweep Oscillator and Sweep Drive Circuit
901 - 999 - Modifications and Special Circuits

*Indicates value of component adjusted at factory, and may deviate from value shown on print.

—O— 16 Indicates printed circuit board terminal.

N O T I C E

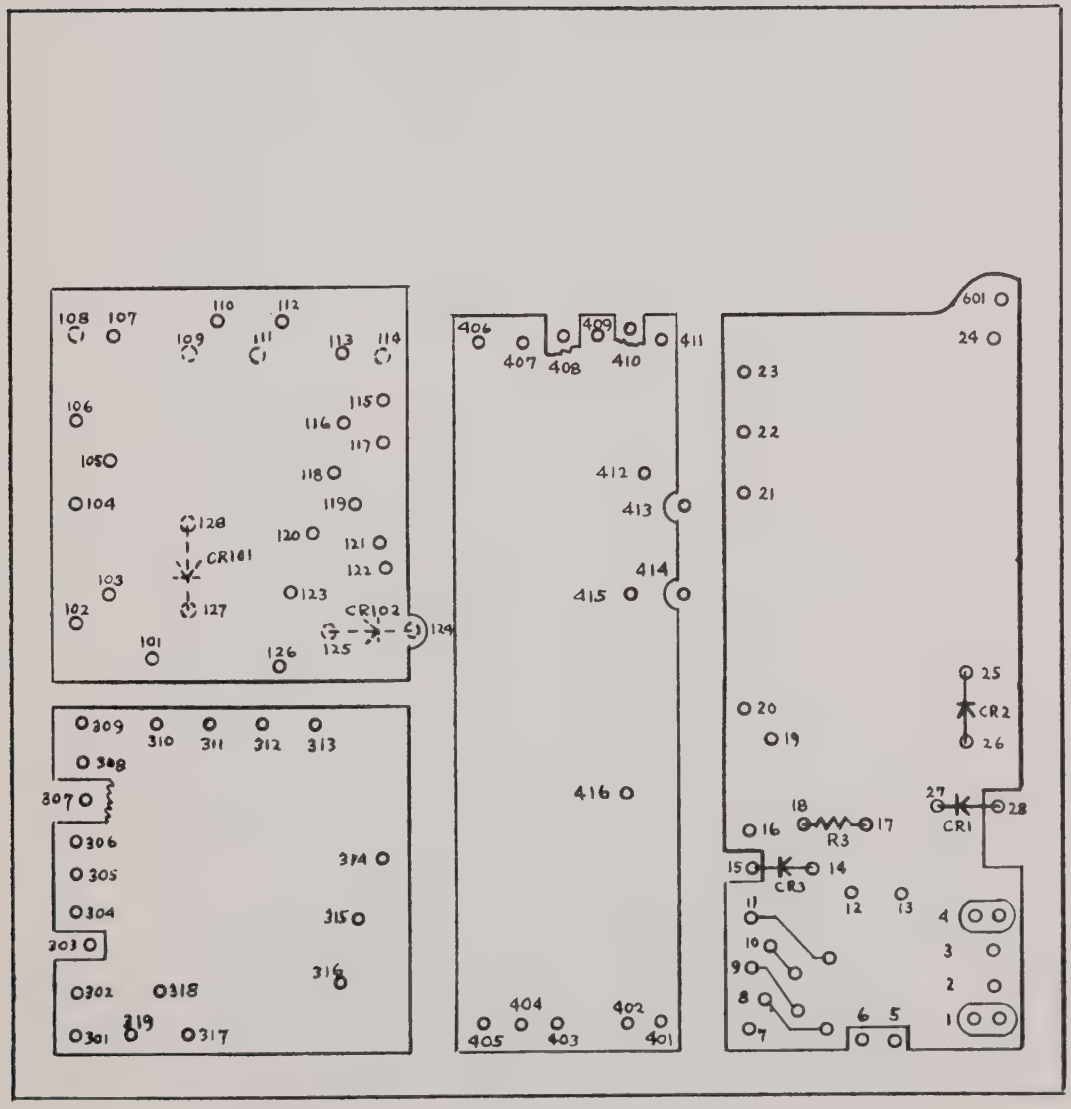
RED LACQUER IS USED TO INDICATE FASTENINGS THAT SHOULD NOT BE DISTURBED FOR ORDINARY SERVICE, AND TO SECURE ADJUSTABLE CONTROLS.

# CHASSIS LAYOUT

BOTTOM VIEW

TERMINALS

FRONT



# MODIFICATION TO HD-1A PARTS LIST

The following parts have been changed, added to or deleted from the HD-1A parts list on the opposite page:

| CIRCUIT REFERENCE | DESCRIPTION | TELONIC PART NO. |
|---|---|---|
| C816 | CFN, 0.36pf, ±10%, 500VDCW | C-30 |
| J801 | RJ, UG-185/U | J-3 |
| J802 | PO Z804 | NA |
| J803 | PO S802 | NA |
| J804 | PO S802 | NA |
| J805 | PO S802 | NA |
| J806 | PO Z803 | NA |
| J807 | PO Z803 | NA |
| J808 | PO S802 | NA |
| J809 | PO S802 | NA |
| J810 | PO S802 | NA |
| J811 | Same as J801 | |
| J812 | RJ, UG-535/U | J-6 |
| J813 | Same as J801 | |
| J814 | TC, MX-1684/U | J-9 |
| P801-P813 | PC, UG-88B/U | J-32 |
| L816 | IF | NA |
| L817 | IF, (SC) | NA |
| R805 | RFC, 10MΩ, ±10%, 1/2 W | R-47 |
| R807 | Omitted | |
| R811 | RFC, 51Ω, ±5%, 1/2 W | R-3 |
| R812 | Omitted | |
| R813 | Omitted | |
| S802 | ASW | 31020 |
| Z803 | Filter, low-pass | 06055 |

# PARTS LIST

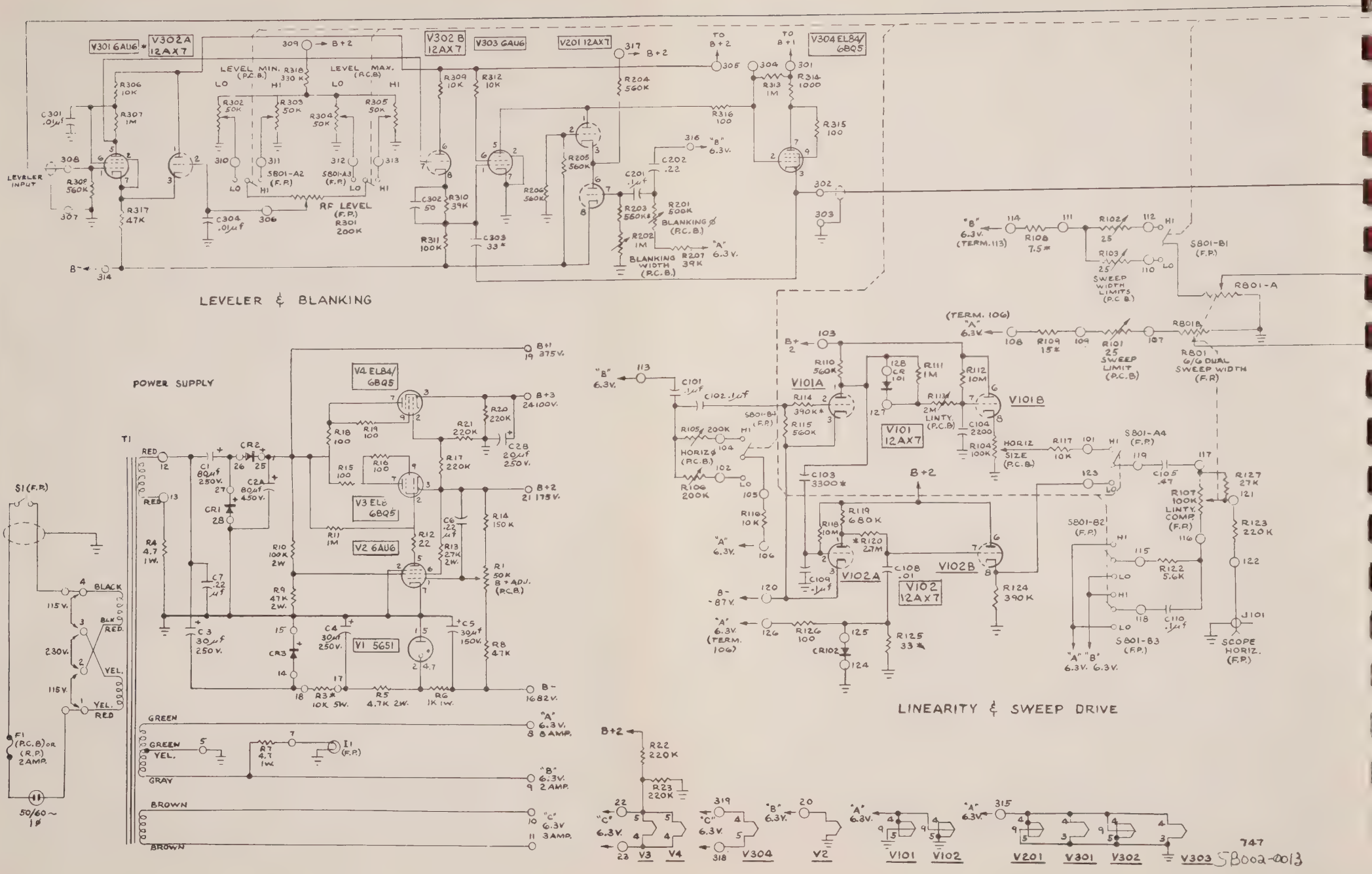
| CIRCUIT REF. | DESCRIPTION | TELONIC PART NO. |
|---|---|---|
| C1 | CFE, 80μf, 250VDCW | C-314 |
| C2 | CFE, 20/80μf, 250/450VDCW | C-308 |
| C3 | CFE, 30μf, 250VDCW | C-313 |
| C4 | Same as C3 | |
| C5 | CFE, 30μf, 150VDCW | C-312 |
| C6 | CFP, 0.22μf, ±20%, 400VDCW | C-217 |
| C7 | Same as C6 | |
| C101 | CFP, 0.1μf, ±10%, 200VDCW | C-203 |
| C102 | Same as C101 | |
| C103 | CFM, 3300pf, ±10%, 500VDCW | C-52 |
| C104 | CFM, 200pf, ±10%, 500VDCW | C-24 |
| C105 | CFP, 0.47μf, 200VDCW | C-223 |
| C106 | NA | |
| C107 | NA | |
| C108 | CFP, 0.01μf, ±10%, 600VDCW | C-210 |
| C109 | Same as C101 | |
| C110 | Same as C101 | |
| C201 | Same as C101 | |
| C202 | Same as C6 | |
| C301 | CFC, 0.01μf, +80-20%, 500VDCW | C-20 |
| C302 | CFC, 50pf, ±10%, 1000VDCW | C-11 |
| C303 | CFC, 33pf, ±10%, 1000VDCW | C-10 |
| C304 | Same as C301 | |
| C401 | CFC, 120pf, ±10%, 1000VDCW | C-14 |
| C402 | Same as C301 | |
| C403 | Same as C301 | |
| C404 | Same as C301 | |
| C405 | CFC, 4000pf, GMV, 1000VDCW | C-19 |
| C406 | Same as C405 | |
| C407 | Same as C301 | |
| C408 | Same as C301 | |
| C409 | Same as C301 | |
| C410 | Same as C301 | |
| C411 | Same as C301 | |
| C501 | CFCF, 1000pf, 1000VDCW | C-39 |
| C801 | CFCF, 1000pf, +100-0%, 500VDCW | C-110 |
| C802 | Same as C801 | |
| C803 | Same as C801 | |
| C804 | Same as C801 | |
| C805 | Same as C801 | |
| C806 | Same as C501 | |
| C807 | Same as C501 | |
| C808 | Same as C501 | |
| C809 | Same as C501 | |
| C810 | Same as C501 | |
| C811 | Same as C501 | |
| C812 | Same as C501 | |
| C813 | Same as C501 | |
| C814 | CFC, 4pf, ±5%, 500VDCW | C-41 |
| C815 | Same as C814 | |
| C816 | CFN, 0.43pf, ±10%, 500VDCW | C-58 |
| C817 | CFE (SC) | |
| C818 | CFE (SC) | |
| C819 | CFN, 3pf, ±10%, 500VDCW | C-34 |
| C820 | Same as C301 | |
| CR1 | DS, 1N2094 | D-7 |
| CR2 | Same as CR1 | |
| CR3 | Same as CR1 | |
| CR101 | Same as CR1 | |
| CR102 | Same as CR1 | |
| CR501 | DS, 1N82 | D-1 |
| CR801 | Same as CR501 | |
| CR802 | Same as CR501 | |
| CR803 | Same as CR501 | |
| CR804 | Same as CR501 | |
| CR805 | DS, 1N218 | D-3 |
| F1 | Fuse, 3AG, 2a, 250V | MP-6 |
| I1 | Lamp, Incandescent, #47 | MP-5 |
| J101 | RJ, 2545-1 | J-10 |
| J401 | Same as J101 | |
| J402 | Same as J101 | |
| J501 | TC, MX1684/U | J-9 |
| J502 | Same as J501 | |
| J503 | RJ, 2559-1 | J-11 |
| J504 | Same as J501 | |
| J505 | Same as J501 | |
| J506 | JRTA | J-23 |
| J507 | Same as J506 | |
| J701 | PO Z701 | |
| J702 | PO Z701 | |
| J703 | Same as J503 | |
| J801 | PO Z803 | |
| J802 | PO Z804 | |
| J803 | PO S802 | |
| J804 | PO S802 | |
| J805 | PO S802 | |
| J806 | RJ, UG-185/U | J-3 |
| J807 | RJ, UG-535/U | J-6 |
| J808 | Same as J806 | |
| L401 | IV, 6 to 11 mh | L-23 |
| L801 | IF, 0.3μh | L-104 |
| L802 | IF, 2.2μh, ±10% | L-101 |
| L803 | Same as L802 | |
| L804 | IF, 2.2μh, ±20% | L-100 |
| L805 | IF, 0.6μh | L-29 |
| L806 | Same as L801 | |
| L807 | Same as L805 | |
| L808 | Same as L802 | |
| L809 | Same as L802 | |
| L810 | Same as L804 | |
| L811 | IF | 09027 |
| L812 | IF | 09028 |
| L813 | IF | 09029 |
| L814 | IV | 09035 |
| L815 | IF, 0.68μh, ±15% | L-103 |

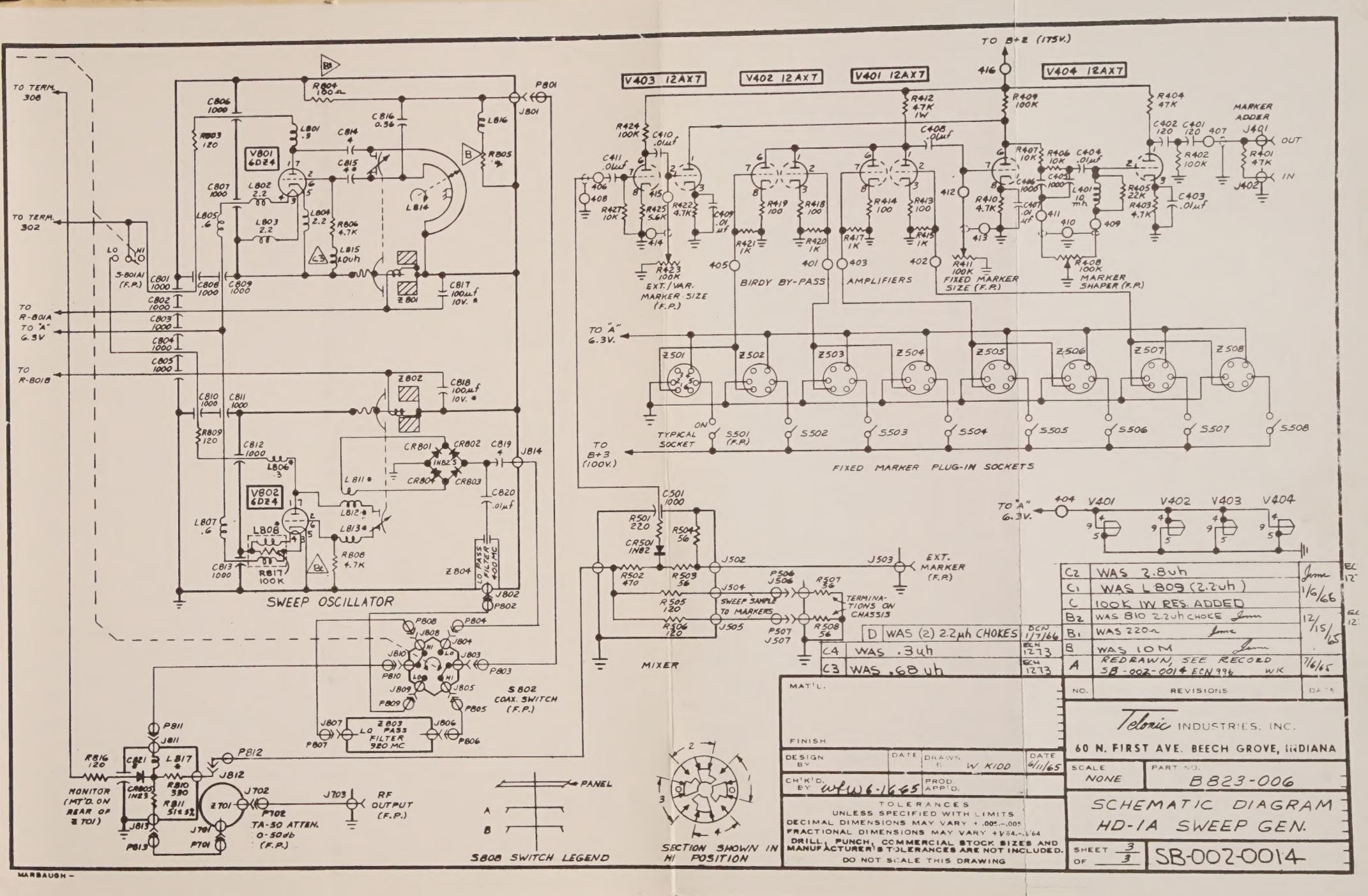
| CIRCUIT REF. | DESCRIPTION | TELONIC PART NO. |
|---|---|---|
| P506 | PC, UG-88B/U | J-32 |
| P507 | Same as P506 | |
| P701 | Same as P506 | |
| P702 | Same as P506 | |
| P801 | Same as P506 | |
| P802 | Same as P506 | |
| P803 | Same as P506 | |
| P804 | Same as P506 | |
| P805 | Same as P506 | |
| P806 | Same as P506 | |
| P807 | Same as P506 | |
| P808 | Same as P506 | |
| R1 | RVC, 50KΩ, ±30%, 2/10W | R-725 |
| R2 | NA | |
| R3 | RFW, 10KΩ, ±5%, 5W | R-404 |
| R4 | RFC, 4.7Ω, ±10%, 1W | R-206 |
| R5 | RFC, 4.7KΩ, ±10%, 2W | R-306 |
| R6 | RFC, 1KΩ, ±10%, 1W | R-208 |
| R7 | Same as R4 | |
| R8 | RFC, 47KΩ, ±10%, 1/2W | R-27 |
| R9 | RFC, 47KΩ, ±10%, 2W | R-305 |
| R10 | RFC, 100KΩ, ±10%, 2W | R-303 |
| R11 | RFC, 1MΩ, ±10%, 1/2W | R-31 |
| R12 | RFC, 22Ω, ±10%, 1/2W | R-11 |
| R13 | RFC, 27KΩ, ±10%, 2W | R-304 |
| R14 | RFC, 180KΩ, ±10%, 1/2W | R-45 |
| R15 | RFC, 100Ω, ±10%, 1/2W | R-15 |
| R16 | Same as R15 | |
| R17 | RFC, 220KΩ, ±10%, 1/2W | R-44 |
| R18 | Same as R15 | |
| R19 | Same as R15 | |
| R20 | Same as R17 | |
| R21 | Same as R17 | |
| R22 | Same as R17 | |
| R23 | Same as R17 | |
| R101 | RVW, 25Ω, ±10%, 2W | R-713 |
| R102 | Same as R101 | |
| R103 | Same as R101 | |
| R104 | RVC, 100KΩ, ±30%, 2/10W | R-732 |
| R105 | RVC, 200KΩ, ±30%, 2/10W | R-724 |
| R106 | Same as R105 | |
| R107 | PO R801 | |
| R108 | RFW, 7.5Ω, ±10%, 5W | R-403 |
| R109 | Same as R108 | |
| R110 | RFC, 560KΩ, ±10%, 1/2W | R-29 |
| R111 | Same as R11 | |
| R112 | RFC, 10MΩ, ±10%, 1/2W | R-47 |
| R113 | RVC, 2MΩ, ±30%, 2/10W | R-729 |
| R114 | RFC, 390KΩ, ±10%, 1/2W | R-72 |
| R115 | Same as R110 | |
| R116 | RFC, 10KΩ, ±10%, 1/2W | R-23 |
| R117 | Same as R116 | |
| R118 | Same as R112 | |
| R119 | RFC, 680KΩ, ±10%, 1/2W | R-30 |
| R120 | RFC, 3.3MΩ, ±10%, 1/2W | R-49 |
| R121 | NA | |
| R122 | RFC, 5.6KΩ, ±10%, 1/2W | R-22 |
| R123 | Same as R17 | |
| R124 | Same as R114 | |
| R125 | RFC, 33Ω, ±10%, 1/2W | R-12 |
| R126 | Same as R15 | |
| R127 | RFC, 27KΩ, ±10%, 1/2W | R-25 |
| R201 | RVC, 500KΩ, ±30%, 2/10W | R-734 |
| R202 | RVC, 1MΩ, ±30%, 2/10W | R-728 |
| R203 | Same as R110 | |
| R204 | Same as R110 | |
| R205 | Same as R110 | |
| R206 | Same as R110 | |
| R207 | RFC, 39KΩ, ±10%, 1/2W | R-26 |
| R301 | RVC, 200KΩ, ±30%, 1/4W | R-707 |
| R302 | Same as R1 | |
| R303 | Same as R1 | |
| R304 | Same as R1 | |
| R305 | Same as R1 | |
| R306 | Same as R116 | |
| R307 | Same as R11 | |
| R308 | Same as R110 | |
| R309 | Same as R116 | |
| R310 | Same as R207 | |
| R311 | RFC, 100KΩ, ±10%, 1/2W | R-28 |
| R312 | Same as R116 | |
| R313 | Same as R11 | |
| R314 | Same as R15 | |
| R315 | Same as R15 | |
| R316 | Same as R15 | |
| R317 | Same as R8 | |
| R318 | RFC, 330KΩ, ±10%, 1/2W | R-94 |
| R401 | Same as R8 | |
| R402 | Same as R311 | |
| R403 | RFC, 4.7KΩ, ±10%, 1/2W | R-21 |
| R404 | Same as R8 | |
| R405 | RFC, 22KΩ, ±10%, 1/2W | R-24 |
| R406 | Same as R116 | |
| R407 | Same as R116 | |
| R408 | RVC, 100KΩ, ±30%, 1/3W | R-705 |
| R409 | Same as R311 | |
| R410 | Same as R403 | |
| R411 | Same as R408 | |
| R412 | Same as R210 | |
| R413 | Same as R15 | |
| R414 | Same as R15 | |
| R415 | RFC, 1KΩ, ±10%, 1/2W | R-18 |
| R416 | NA | |
| R417 | Same as R415 | |
| R418 | Same as R15 | |
| R419 | Same as R15 | |
| R420 | Same as R415 | |
| R421 | Same as R415 | |
| R422 | Same as R403 | |
| R423 | Same as R408 | |
| R424 | Same as R311 | |
| R425 | Same as R122 | |
| R426 | NA | |
| R427 | Same as R116 | |

| CIRCUIT REF. | DESCRIPTION | TELONIC PART NO. |
|---|---|---|
| R501 | RFC, 220Ω, ±10%, 1/2W | R-39 |
| R502 | RFC, 470Ω, ±10%, 1/2W | R-42 |
| R503 | RFC, 56Ω, ±5%, 1/2W | R-53 |
| R504 | Same as R503 | |
| R505 | RFC, 120Ω, ±10%, 1/2W | R-16 |
| R506 | Same as R505 | |
| R507 | PO J506 | |
| R508 | PO J507 | |
| R801 | RVW/W/C, 6Ω/6Ω/100KΩ, 2W/2W 1/3W | R-735A |
| R802 | NA | |
| R803 | Same as R505 | |
| R804 | Same as R501 | |
| R805 | RFC, 180Ω, ±10%, 1/2W | R-52 |
| R806 | Same as R403 | |
| R807 | Same as R505 | |
| R808 | Same as R403 | |
| R809 | Same as R505 | |
| R810 | RFC, 330Ω, ±10%, 1/2W | R-17 |
| R811 | RFC, 300Ω, ±5%, 1/2W | R-77 |
| R812 | Same as R811 | |
| R813 | RFC, 18Ω, ±10%, 1/2W | R-78 |
| R814 | RFC, 56Ω, ±10%, 1/2W (NS) | R-13 |
| R815 | RFC, 2.2MΩ, ±10%, 1/2W (NS) | R-34 |
| R816 | Same as R505 | |
| S1 | SWT, SPST | SW-10 |
| S501-S508 | Same as S1 | |
| S801 | PO S802 | |
| S802 | ASW | 31001 |
| T1 | TP | T-9A |
| V1 | TE, 5651 | VT-17 |
| V2 | TE, 6AU6 | VT-5 |
| V3 | TE, EL84/6BQ5 | VT-16 |
| V4 | Same as V3 | |
| V101 | TE, 12AX7 | VT-13 |
| V102 | Same as V101 | |
| V201 | Same as V101 | |
| V301 | Same as V2 (SC) | |
| V302 | Same as V101 | |
| V303 | Same as V2 | |
| V304 | Same as V3 | |
| V401 | Same as V101 | |
| V402 | Same as V101 | |
| V403 | Same as V101 | |
| V404 | Same as V101 | |
| V801 | TE, 6AF4 or 6DZ4 | VT-4 or VT-51 |
| V802 | Same as V801 | |
| Z501-Z508 | Socket, wafer | S-11 |
| Z701 | Attenuator, RF | 05005 |
| Z801 | Drive Motor | 09021 |
| Z802 | Drive Motor | 09022 |
| Z803 | Filter, low pass | 06010 |
| Z804 | Filter, low pass | 06009 |
| | Post, fuse | S-27 |
| | Nib, tuning | SM-2 |
| | Clip, diode | S-19 |
| | Socket, diode (5 required) | S-9 |
| | Socket, 7-pin (2 required) | S-7 |
| | Socket, 7-pin (4 required) | S-4 |
| | Socket, 9-pin (11 required) | S-5 |
| | Pilot Light Assembly | MP-3 |

ABBREVIATION CODE

| | |
|---|---|
| ASW | Assembly, Switch |
| CFC | Capacitor, fixed, ceramic |
| CFCF | Capacitor, fixed, ceramic feed-thru |
| CFE | Capacitor, fixed, electrolytic |
| CFM | Capacitor, fixed, mica |
| CFN | Capacitor, fixed, composition |
| CFP | Capacitor, fixed, paper |
| D | Diode, semiconductor |
| IF | Inductor, fixed |
| IV | Inductor, variable |
| JRTA | Jack resistive terminating assembly |
| NA | Not assigned |
| NS | Not on schematic |
| PC | Plug, cable |
| PO | Part of |
| RFC | Resistor, fixed, composition |
| RFW | Resistor, fixed, wirewound |
| RJ | Receptacle, Jack |
| RVC | Resistor, variable, composition |
| RVW | Resistor, variable, wirewound |
| RVW/W/C | Resistor, variable wirewound, wirewound, composition |
| SC | Subject to change |
| SWT | Switch, Toggle |
| T | Terminator, cable |
| TE | Tube, electron |
| TP | Transformer, power |


V301 6AU6
V302A 12AX7
V302B 12AX7
V303 6AU6
V201 12AX7
V304 EL84/6BQ5
LEVELER INPUT
LEVEL MIN. (P.C.B.)
LEVEL MAX. (P.C.B.)
RF LEVEL (F.P.) R301 200K
5801-A2 (F.P.)
5801-A3 (F.P.)
BLANKING Ø (P.C.B.)
BLANKING WIDTH (P.C.B.)
LEVELER & BLANKING
POWER SUPPLY
V4 EL84/6BQ5
V3 EL84/6BQ5
V2 6AU6
V1 5651
LINEARITY & SWEEP DRIVE
V101 12AX7
V102 12AX7
SWEEP WIDTH LIMITS (P.C.B.)
R801 G/G DUAL SWEEP WIDTH (F.P.)
SWEEP LIMIT (P.C.B.)
LINTY. (P.C.B.)
HORIZ SIZE (P.C.B.)
LINTY. COMP. (F.P.)
SCOPE HORIZ. (F.P.)
747
V303 5B002-0013




| | | | |
|---|---|---|---|
| C2 | WAS 2.8uh | | June 1/6/66 |
| C1 | WAS L809 (2.2uh) | | |
| C | 100K 1W RES. ADDED | | |
| B2 | WAS 810 2.2uh CHOKE June | | 12/15/65 |
| B1 | WAS 220Ω June | | |
| B | WAS 10M June | | |
| A | REDRAWN, SEE RECORD SB-002-0014 ECN 996 WK | | 7/6/65 |
| D | WAS (2) 2.2μh CHOKES | DCN 1/7/66 | |
| C4 | WAS .3uh | ECN 1273 | |
| C3 | WAS .68 uh | ECN 1273 | |

NO. REVISIONS DATE

MAT'L.

FINISH

| DESIGN BY | DATE | DRAWN | DATE |
|---|---|---|---|
| | | B. W. KIDD | 6/11/65 |
| CH'K'D. BY WFW 6-16-65 | | PROD. APP'D. | |

TOLERANCES
UNLESS SPECIFIED WITH LIMITS
DECIMAL DIMENSIONS MAY VARY + .005-.005
FRACTIONAL DIMENSIONS MAY VARY +1/64-1/64
DRILL, PUNCH, COMMERCIAL STOCK SIZES AND MANUFACTURER'S TOLERANCES ARE NOT INCLUDED.
DO NOT SCALE THIS DRAWING

Teloric INDUSTRIES, INC.
60 N. FIRST AVE. BEECH GROVE, INDIANA

| SCALE | PART NO. |
|---|---|
| NONE | B823-006 |

SCHEMATIC DIAGRAM
HD-1A SWEEP GEN.

SHEET 3 OF 3 — SB-002-0014

MARBAUGH